RAISING REINDEER IN ALASKA

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SUCCESS HAS FOLLOWED the missionary zeal and practical cooperation that first brought reindeer to Alaska. Many of the Alaskans have now advanced from a precarious reliance on a dwindling game supply to a competence based on a productive industry; and as improvements are made in methods of handling the reindeer, the industry is expanding and providing a livelihood for an increasing number of people.

The Alaskans first learned from Lapland herders how to care for the newly imported animals and how to utilize them for food and clothing. As time passed, however, the methods and practices adopted from the Laplanders began to show serious defects; the reindeer were deteriorating, and the ranges were getting overstocked. These conditions called for a scientific study of the Territory's grazing resources and the working out of improved methods of herd and range management. Congress authorized such a study, and in 1920 the Bureau of Biological Survey undertook the work. In cooperation with the Alaska College of Agriculture and School of Mines the investigations are being continued at the Reindeer Experiment Station, College, Alaska; at substations at Nome and on Nunivak Island; and on the ranges.

This publication presents the latest developments in these studies and furnishes directions for carrying out the improved practices. It supersedes Circular No. 82, Improved Reindeer Handling.

Washington, D.C. November 1934

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RAISING REINDEER IN ALASKA

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DEVELOPMENT OF THE REINDEER INDUSTRY IN ALASKA

Reindeer were introduced into Alaska from Siberia to replenish the Eskimo larder in view of threatened game depletion and to establish a productive industry for this northern region. Through importations during the years 1891 to 1902, 1,280 animals were established, mainly at Teller on the Seward Peninsula. From this

FIGURE 1.—Reindeer grazing on Alaska range. B32366

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original number have developed the present herds, approximately a million reindeer, distributed from Point Barrow on the north to Kodiak Island on the south and from the coastal belt bordering Bering Sea and the Arctic Ocean to Ophir in the interior. Most of the animals are ranged (fig. 1) along the coast, and the heaviest concentration is still on Seward Peninsula.

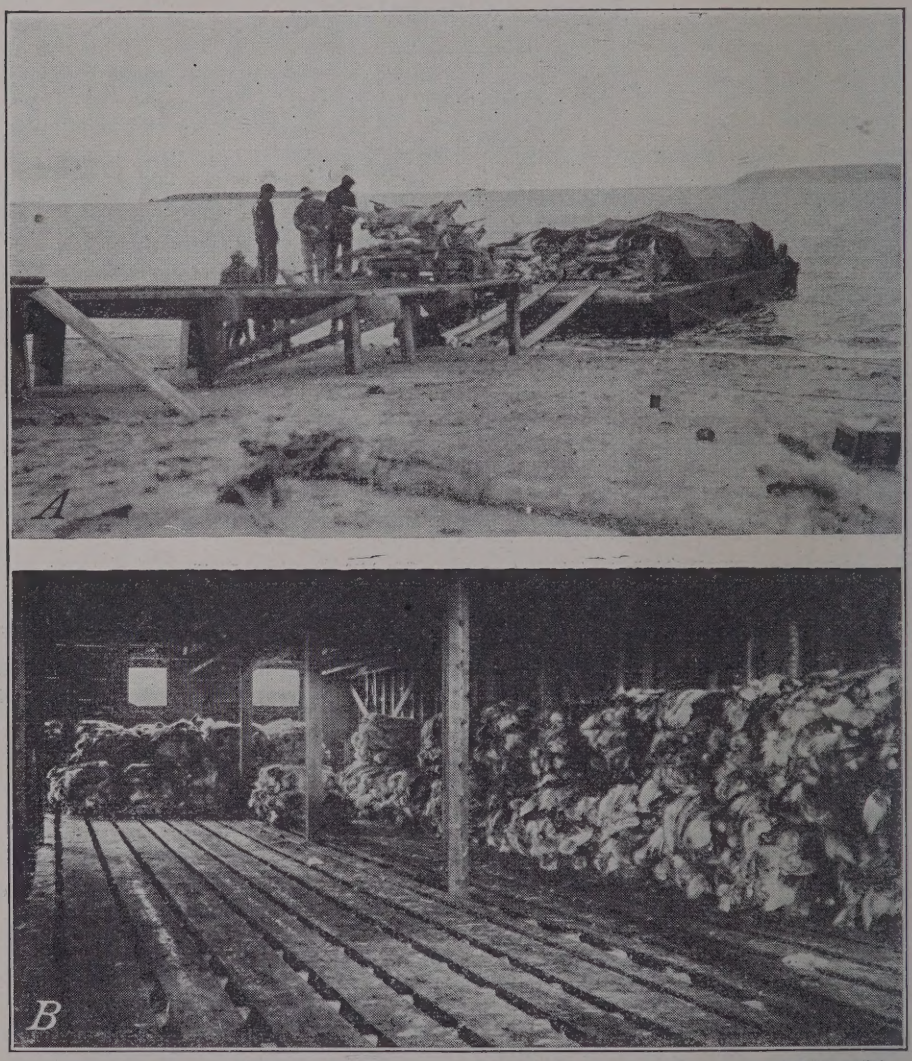

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FIGURE 2.—Products of the reindeer industry: *A*, Frozen meat being lightered from cold-storage plant to refrigerator steamship; *B*, hides ready for shipment.

Raising reindeer, now an established industry, is engaged in by both Eskimos and whites, but the Eskimos own approximately two-thirds of the stock. The original purpose of the importations has been accomplished, and a surplus of animals has developed, enabling the industry to export reindeer products.

The more important of these products are meat and hides (fig. 2). Reindeer hides provide a fine leather much used in the manufacture of kid gloves and leather jackets. Skins are also utilized locally in making winter garments—boots, parkas, mittens, socks, leggings,

trousers—and sleeping bags. The export for 1930 was 20,000 hides, as compared with about 14,000 in 1929 and somewhat more than 8,000 in 1928.

The reindeer meat used for food includes the heart, liver, and tongue. Some canning has been successfully done, and jerked or smoked reindeer meat is a highly prized local product. Reindeer meat for the market is prepared under modern methods of slaughtering and shipping (fig. 3). Several cold-storage plants are in operation at points along the coast, and the meat is shipped to the

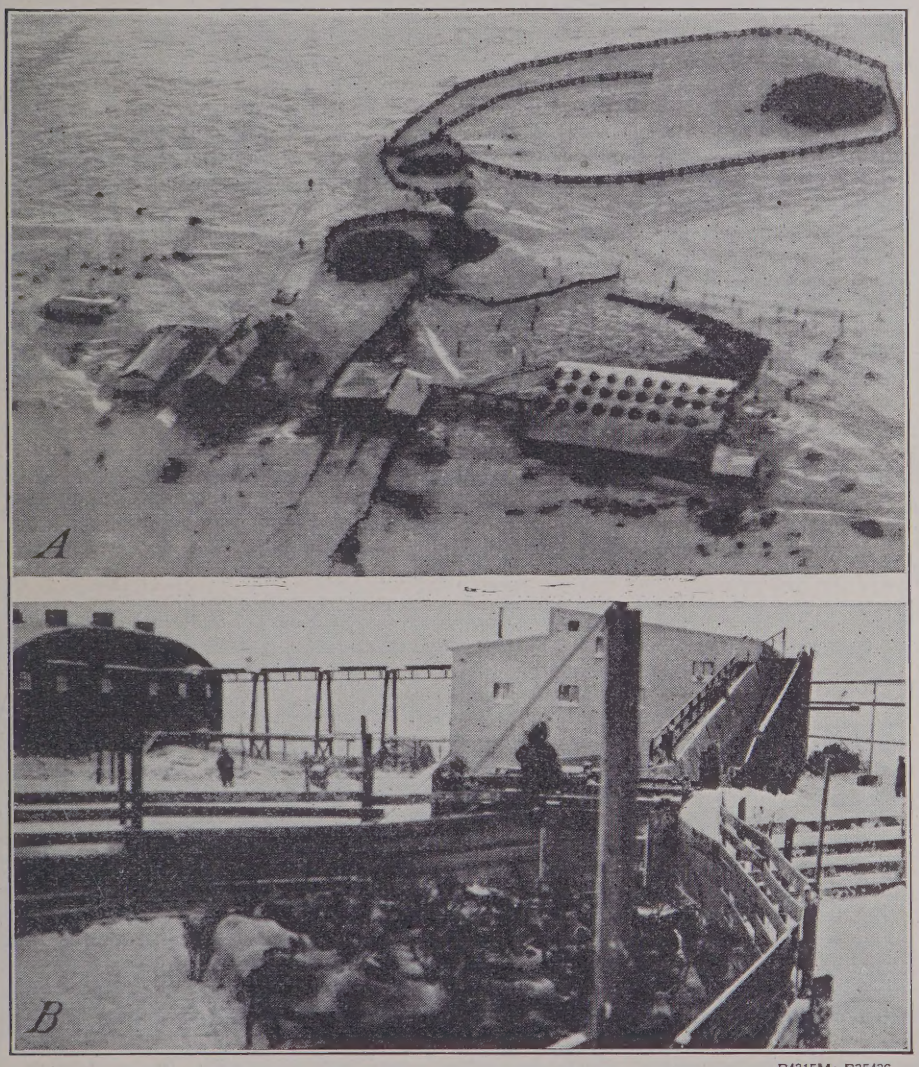

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FIGURE 3.—Modern reindeer plant at Elephant Point, Alaska, showing reindeer at corrals: *A*, Airplane view; *B*, slaughterhouse and cold-storage plant.

United States under refrigeration. In 1928, about 1,000,000 pounds of meat were exported; in 1929, a little less than 2,000,000 pounds; and in 1930, 2,500,000 pounds.

The antlers, bones, blood, and viscera are used in the preparation of meals fed to dogs and foxes, and the antlers have been exported for use in the manufacture of knife handles and similar articles.

In other countries in which reindeer are raised, the milk is used for making cheese and butter, but in Alaska no reindeer milking is done.

In Alaska the reindeer is used to a slight extent as a beast of burden—for packing in summer and for drawing sleds in winter.

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FIGURE 4.—Reindeer train hauling camp supplies.

Readily broken to halter and to pulling a sled (fig. 4), the average animal can carry 60 to 70 pounds or pull a loaded sled weighing 100 to 300 pounds, according to trail conditions, and cover 20 to 25 miles a day.

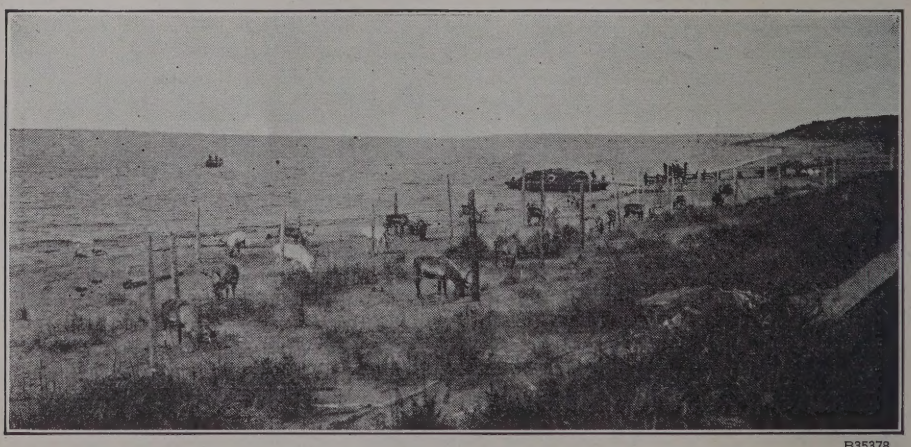

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FIGURE 5.—Reindeer staked out on the beach ready for shipment to the United States for Christmas display.

A recent development in the industry is the shipping of trained reindeer to the United States each year for display purposes at Christmas time (fig. 5).

RATE OF REINDEER INCREASE

Formerly, when herds were of small size and under closer control, the net annual herd increase in Alaska ran between 25 and 33⅓

percent. Now, however, with the growth of large herds and consequent increase in the problems of handling, the annual increase does not exceed 20 percent. Fawn crops average between 50 and 60 percent of the adult doe population, although in the better-managed herds they may reach 70 percent, and under ideal conditions of herd and range management 85 to 90 percent. Male and female fawns usually occur in about equal numbers.

The average annual loss among adult reindeer is about 6.5 percent and among fawns about 15 percent. Losses among adults result principally from straying, parasitic and other diseases, injury in handling, and predatory animals; among the fawns losses are chiefly from desertion by mothers, stillbirths, predatory animals, and parasites.

Information regarding the parasitic and other diseases of reindeer and their treatment may be found in Department of Agriculture Bulletin 1089, Reindeer in Alaska.[1]

There is usually only one fawn at a birth, twins being of rare occurrence. The new-born fawn is remarkably hardy and is strong and fleet of foot soon after birth. Sometimes yearling reindeer reproduce, and according to the opinion held generally the average reindeer doe breeds to the age of 10 or 12 years.

FUTURE OF THE INDUSTRY

It is estimated that there are 350,000 square miles of grazing land in Alaska, of which 200,000 square miles are particularly suited to raising reindeer. The carrying capacity of such an area should be approximately 4,000,000 reindeer, the annual surplus of which should yield about 1,000,000 hides and 150,000,000 pounds of meat.

The development of reindeer herding along the coasts of Bering Sea and the Arctic Ocean has meant the disappearance of the native wild caribou there, for reindeer and caribou cannot together occupy the same range. This section is ideally situated for reindeer production, and the disappearance of the caribou therefore was unavoidable. Eastern parts of Alaska, however, are less suitable for handling reindeer effectively, and the thriving herds of caribou there constitute a natural resource of great interest and value to the general public, as well as to the prospector and traveler. In view of the great intrinsic value of both reindeer and caribou, and of the fact that the two cannot exist together, it will be well to have certain areas definitely recognized as caribou range and to exclude the reindeer therefrom. Since both animals are important to Alaska, introducing reindeer on the remaining caribou ranges would have serious consequences. For future uses and enjoyment, the pure caribou strain should be preserved in the major areas now occupied by these large wild animals, though, of course, within the present reindeer country, the desirability of utilizing caribou in directed crossbreeding experiments for the improvement of the reindeer herds is unquestioned (see p. 36).

Because of damage caused by grubs of the warble fly, the value of reindeer hides is depreciated 75 to 80 percent. This, of course, entails a tremendous loss, and the problem of eradicating this de-

[1] For sale by Superintendent of Documents, Government Printing Office, Washington, D.C., at 25 cents a copy.

structive parasite is being given special study. If it is successfully solved, a saving of several million dollars will be effected.[2]

Fur farming is also an important industry, and one of its outstanding problems is that of procuring a steady supply of reasonably cheap meat to feed the animals. Reindeer meat can well fill this need, and in the future it may be used for this purpose also.

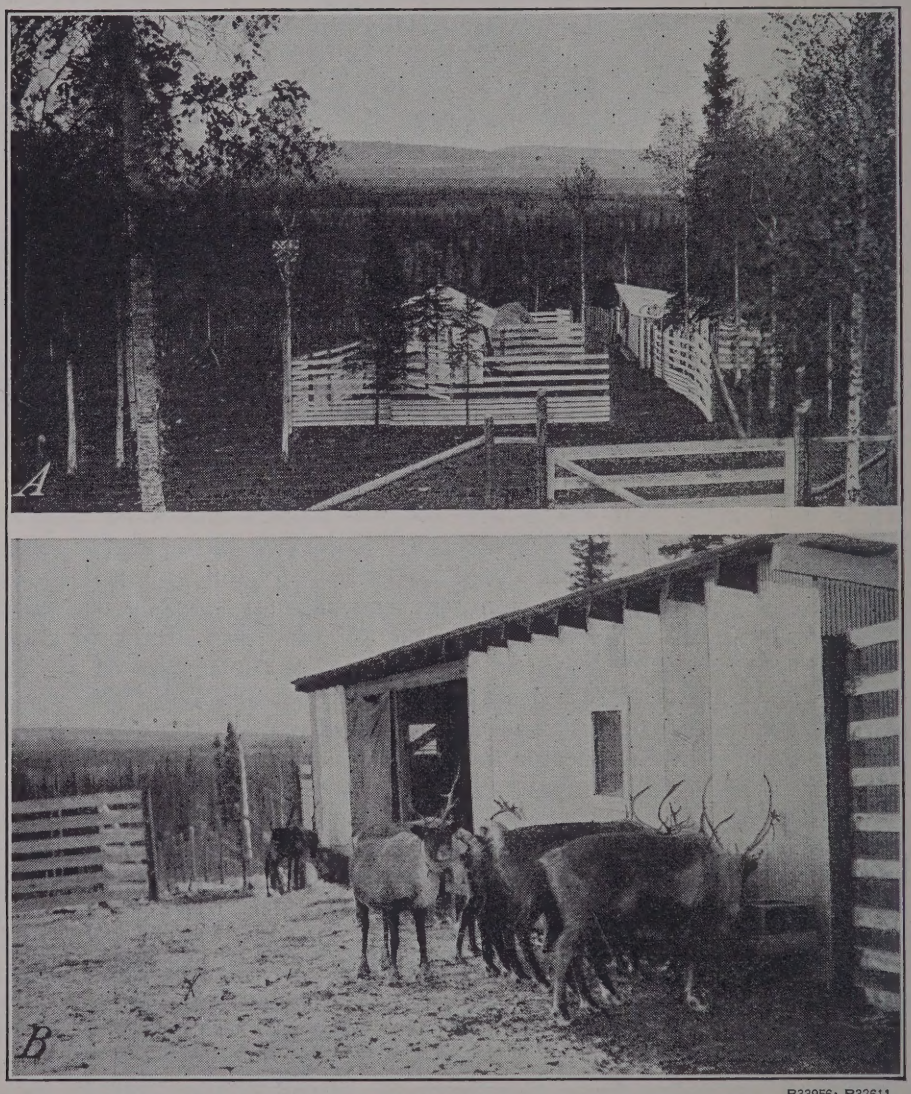

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FIGURE 6.—*A*, Part of the Reindeer Experiment Station maintained by the Bureau of Biological Survey at the Alaska Agricultural College and School of Mines; *B*, reindeer in feed yard at the station.

REINDEER EXPERIMENT STATION

Scientific investigation of reindeer production was begun by the Bureau of Biological Survey in 1920. Following preliminary field work, the Reindeer Experiment Station was established, January 1,

[2] The Territorial Legislature appropriated $10,000 to be expended during 1929–30 in a study of the reindeer warble grub, and a further sum of $6,000 was appropriated for 1931–32 to continue the project. The study was initiated at Golovin, Alaska, and conducted by a specialist of the Bureau of Entomology, but owing to lack of funds the project was discontinued in 1933, before conclusive results could be obtained.

1928, at College, Alaska (fig. 6). Substations are maintained at Nome and on Nunivak Island, in Bering Sea. The main station is partly on reserve lands set aside by Executive order and partly on adjoining college property. The land is of value chiefly for grazing and is not suitable for cultivation. A varied vegetative cover consists principally of grassy woodland, spruce swamp, and tundra, the forage composition including 4 types and 17 subtypes. A total of 2,195 acres of the area is under fence and is divided into 15 pastures. Several shelter sheds, corrals, and other facilities make possible a convenient handling of animals used in the experiments. Detailed studies pertaining to feeding, breeding, grazing capacity, forage, habits of the animals, morphology, and handling are conducted. The information thus gained is combined with the more general observations being made at the Nome field station, where the work also includes range reconnaissance and assistance at roundups. On Nunivak Island, crossbreeding experiments with reindeer and caribou are being carried on to supplement similar work at the main station.

COOPERATING AGENCIES

The Alaska Agricultural College and School of Mines and the Alaska Railroad cooperate with the Bureau of Biological Survey in its reindeer studies, and aid is given by other bureaus of the Department of Agriculture. The quality of the meat and its proper preparation for use are studied by a special reindeer committee in Washington, D.C., including representatives of the Bureaus of Animal Industry, Home Economics, Agricultural Economics, Chemistry and Soils, and Biological Survey. Digestion experiments, vitamin studies, and food analyses are also included in the program of these agencies. Methods of eradicating the reindeer warble fly and other insects have been studied by the Bureau of Entomology and Plant Quarantine. (See footnote 2, p. 6). The results of studies relating to cooking reindeer meat made by the Bureau of Home Economics have been published by the Department in Leaflet No. 48, Reindeer Recipes, and further work of a similar nature is planned.

CHARACTERISTICS OF REINDEER

The reindeer may be said to be a domesticated caribou. It has been developed from the wild caribou of northern Europe and Asia through countless generations, and as the breeding up was without particular direction, the present type is perhaps not far removed from the original. There is some difference, however, in conformation and general coloration between reindeer of Siberian descent and the caribou of Alaska and Canada (fig. 7) and considerable difference in the temperament of the animals and in range habits. The caribou (fig. 7, *D*) is much longer of leg, and is more ungainly in appearance. Its ears are a trifle larger. Its nose is inclined to the Roman type, and the underlip is short and drawn up; whereas the reindeer is frequently dish-faced, and the underlip not so trim.

COLOR

The reindeer of Alaska (*Rangifer tarandus*) is largely brown and gray, with dark legs and head and an almost white mane, which becomes long in winter. The color in individual animals varies from

white, solid gray, and spotted to light and dark brown. With the exception of the white and spotted animals, the general color of reindeer is similar to that of caribou (*R. stonei* and related forms).

CONFORMATION AND TYPES

In conformation the reindeer is symmetrical and gives the impression of blockiness (fig. 7, *B*). Alaska herds have two general types—one, a long, rangy, and big-framed animal; the other, short and stocky. The longer, rangy type has finer, longer, more symmetrically branched, and harder horns; the shorter has stockier, broader horns, wide at the base, and often irregularly branched at the tips.

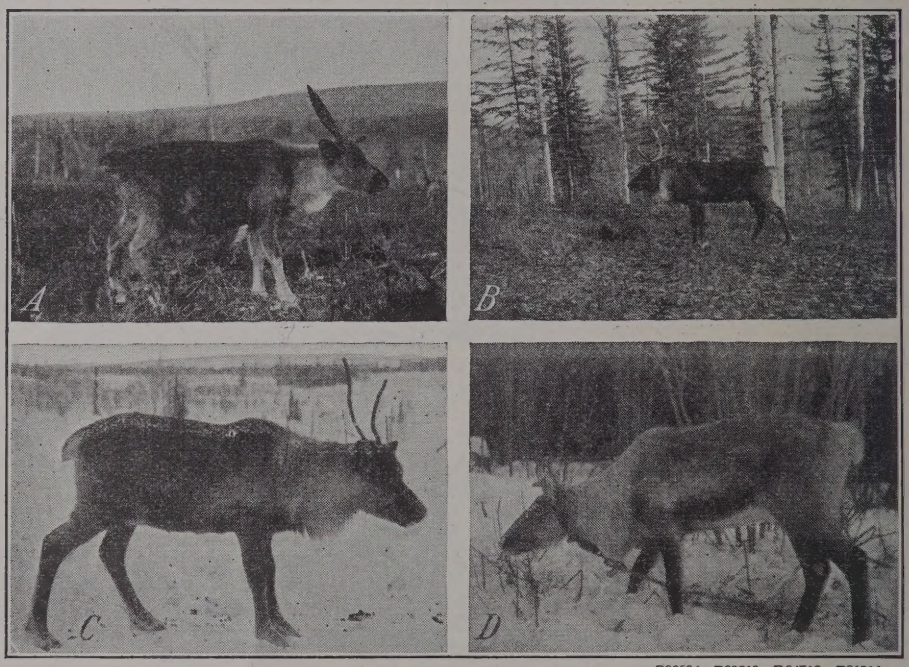

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FIGURE 7.—*A*, Male reindeer fawn fattened on hay and grain at the experiment station; *B*, reindeer buck in good fall condition with smooth coat, rounded outline, thickened neck, and polished antlers; *C*, caribou-reindeer cross fawn; *D*, caribou doe—with longer legs than the reindeer.

SIZE AND WEIGHT

The average full-grown reindeer in Alaska stands 10½ to 11 hands high (42 to 44 inches), and measures 5½ to 6 feet from nose to tip of tail. The average dressed weight is about 150 pounds, exceptionally 200 pounds. The offal runs about 37 percent, and the skin 6 percent, of the live weight, a total of about 43 percent, and the meat, or dressed carcass, constitutes the remainder, about 57 percent.

In prime fall condition, male fawns weigh 125 to 150 pounds and dress 75 to 90 pounds; male yearlings weigh 160 to 210 pounds and dress about 110 pounds; 2-year-old males weigh 225 to 260 pounds and dress about 140 pounds; and 3-year-old males weigh 260 to 300 pounds and dress about 165 pounds.

At 6 months of age the male fawns weigh about 20 pounds more than the females. Among yearlings the males are about 30 pounds

heavier. When 2 years old the males are about 60 pounds heavier, and when 3 years old about 80 pounds heavier.

GROWTH

The weight of reindeer fawns at birth ranges from 7 to 16 pounds, the usual weight being 10 to 13 pounds. The animals double their birth weight in 14 to 16 days and attain full size in 4 or 5 years. They gain rapidly in weight, especially during the first 4 months, the average daily rate of gain during this period being between 0.7 and 0.9 pound. During the fifth month the rate of gain drops to 0.5 or 0.6 pound a day, and during the sixth month to 0.2 pound.

CONDITION

The reserve supply of fat stored up by domestic animals before the beginning of winter, as a rule, is laid on evenly, and generally a large part of it will be found on the omentum, or leaf, in the abdominal cavity. In reindeer, however, there is little leaf fat, and the winter reserve is laid on the back in two masses, one on each side of the backbone; hence it is called back fat. It starts just level with the root of the tail, with the greatest thickness (2 to 3 inches) over the rump, and tapers off like a wedge forward of the kidneys. The thickness of this layer is a true indication of the fatness of the reindeer, for, as it is laid on last, it signifies that all other parts of the animal are fully stocked with fat.

The health of the reindeer is revealed also by the appearance of the coat and development of the antlers (fig. 7, *B*). A smooth, glossy hide indicates a good condition, whereas a dull, uneven coat shows unthriftiness. Early molting and early and clean shedding of the velvet (p. 10) on the antlers denotes a healthy condition, the less thrifty animals being slow in shedding, strips of the velvet adhering to the antlers for a long time. Late and imperfect shedding of the velvet is, furthermore, an indication of retarded sex functioning.

Reindeer have natural periods of loss and gain. Winter is normally the lean season, but during summer the reindeer fatten on the herbaceous and shrubby vegetation. They are at their best during September, October, November, and December and weigh least in April and May. Peak-condition weight in fall and lean-condition weight in spring may differ as much as 60 pounds in steers, and 40 to 50 pounds in other animals, averaging in general about 27 pounds. During winter reindeer respond slowly to changes in their food; in summer and fall the response is much more rapid. The greatest gain is made late in summer and in fall, when the animals are unmolested by mosquitoes and flies, from July 25 to October 15, and when on proper range from October 10 to December 20. The insect-pest season is chiefly from June 22 to July 25, although mosquitoes in some numbers begin to appear much earlier. Where badly harassed at this time, reindeer may lose weight rather than gain, but the normal animal responds quickly to better conditions by putting on weight.

Fawning and rutting cause a noticeable loss in weight. During rutting in the fall, the bucks may lose as much as 50 pounds. In the spring of 1928, following the fawning period, six does at the Reindeer Experiment Station lost, on the average, 23 pounds each.

On the other hand, the condition of health affects rutting or fawning, these functional periods being advanced or retarded according to the good or poor condition of the animals.

Reindeer lose rapidly in weight under adverse circumstances, such as change of food, unthriftiness, or being shifted between ranges far apart. Conversely, they respond quickly to favorable conditions. Caribou are more responsive to environment than reindeer, and, being better rustlers, make more rapid gains. The normal rate of recovery on pasture seems to be between one-fourth and three-fourths of a pound a day; but animals may lose as much as a pound a day. Recovery from excessive loss in condition, however, seems to be slow. Accordingly, a poorly nourished fawn is likely to be permanently stunted, and a badly run-down animal may require several months to regain normal condition.

TEETH

At birth reindeer fawns have 6 temporary incisor teeth, 2 lower canines, and 12 premolars fully up, with 4 molars just appearing through the gums. At 10 to 12 months the temporary incisors and canine teeth are replaced by permanent teeth. The temporary incisors and canines are smaller and somewhat smoother and narrower than the permanent. At the end of the first year there are 4 more molars, a total of 12 premolars and 8 molars. During the second year 4 additional molars appear, and toward the close of the season the 2 anterior premolars are shed and replaced. The total dentition of a 3-year-old animal consists of 34 teeth—6 incisors, 4 canines, 12 premolars, and 12 molars. At 2 years of age the 2 central incisors show signs of wear, and a year later all the incisors and lower canines are worn. At 4 years the teeth begin to separate a little, and year by year the separation and wear go on until at 14 to 15 years the incisor and lower canine teeth are completely worn down to the gums and show only as little round stumps set far apart. Whenever the mouth reaches this condition the usefulness of the animal is past.

SHEDDING ANTLERS

Both males and females of reindeer and caribou have antlers, which are shed and replaced each year. Bucks that have been castrated and fawns lose their horns about the middle of April, barren yearling and 2-year-old does about the middle or the latter part of the same month, and male yearlings the first part. Two-year-old bucks shed the antlers the first part of March, and those 3 years old much earlier, usually in November or December. Reindeer does normally cast their horns 5 to 7 days after dropping the fawn, in April, May, or June. Growth of new horns begins on does 2 to 3 days after shedding the old ones, and on steers and young bucks about 10 days after shedding. Among the older bucks new growth begins in March.

SHEDDING VELVET

The growing antlers are covered with velvet, a thin, short-furred skin. During the period of growth they are soft and full of circulating blood; but upon reaching full growth, they harden and the velvet is shed, or peeled, except that properly castrated steers retain the velvet until the horns fall off in spring. The bucks peel the

velvet earlier than the does, the older bucks usually between the first and the middle of August, and they are in rut by about August 20. The does, as a rule, shed the velvet between the middle of August and the middle of September, sometimes even later, and the fawns a little later than the does.

SHEDDING HAIR

Bucks are the first to shed the hair in spring, and by the middle of June most of them are in good coat. Does are a week or two later in shedding, and yearlings correspond more to the does as regards this time. Old or diseased animals are slower in shedding than those that are healthy, and ragged-coated does may be seen up to the first days of August.

HABITS AND DISPOSITION

Reindeer have some of the characteristics of sheep, some of cattle, and some of horses. They flock together like sheep, graze more like cattle, and in intelligence and activity more nearly approach the horse. They are usually gentle, but like other domestic animals the bucks are vicious during the rutting season. At other times of the year it is perfectly safe to walk about among a herd packed in a corral, the animals invariably giving way on the approach of man. When disturbed or frightened, they run together and mill. Thus it is possible to round up a herd in the open and drive them or lasso any desired animal. They are very active in covering short distances, and display as much speed as an ordinary driving horse.

Ordinarily reindeer travel against the wind. In summer they move about considerably over the range, at times covering distances of 15 to 20 miles a day; but in winter they graze over a comparatively small area, remaining for the most part in one general locality, pawing through the snow to reach lichens and other forage. At fawning time the herd divides, the does grouping by themselves, and the bucks, steers, and some of the yearlings banding together elsewhere.

Reindeer become attached to their accustomed haunts and, once well located on a range, will unerringly return to it if moved away. Unless restrained, they instinctively seek successively their favorite spring, summer, fall, and winter pastures. Such reindeer pests as mosquitoes, horseflies, and warble and nose flies constitute an important factor in the choice of summer pasture, as they cause the herds to resort to the wind-swept areas along the coast, or to ridges and mountain tops in the interior.

Reindeer are excellent swimmers and take readily to water. They graze well on the wettest ground, and frequently may be seen wading out into ponds to feed. Along the coast in Alaska the typical summer range is a wet tundra of hummocky ground with many ponds and sloughs, and over range of this character the animals graze with apparent ease. They are sure of foot and seem to travel as readily over the hummocks as over ground more level and firm.

CHARACTER OF REINDEER RANGE IN ALASKA

Reindeer grazing in Alaska is confined to the northern and western parts, much of it being in the wide stretches of prairie-like tundra

bordering the Bering Sea and the Arctic coast. The heavily forested southeastern section, known as the "panhandle", is outside the reindeer area.

RANGE BELTS

The reindeer area includes three distinct range belts: (1) The coastal region, including the islands; (2) the far-interior country; and (3) an intermediate region, which may be termed the inland-coastal, or coastal-valley, belt. In the coastal region the summer range, consisting chiefly of tundra flats, lies directly along the coast, and the winter range is inland on the coastal uplands. Grazing lands in the far interior are in the mountains, the reindeer usually summering on the mountain tops and wintering either on adjoining protected and favorably exposed areas or on lower ground near timber line. In the intermediate, or coastal-valley, belt, as in the Kuskokwim, Yukon, and Kobuk River Valleys, the reindeer may summer either along the flats and bench lands or on the mountain tops, and winter in the middle, usually timbered, zone between the upper and lower elevations. Choice of range in each belt is determined in summer chiefly by the need of protection against insect pests and in winter by the availability of lichen forage.

TIMBER RANGE

About 50 percent of the Territory is forested to some extent. Excluding southeastern Alaska, the wooded areas lie chiefly in the interior or central parts. The more heavily forested sections are undesirable for reindeer raising, owing to herding difficulties. The treeless tundra region of the coast is particularly suited to this industry. The presence of some trees, however, is desirable for affording shelter to herd and herder and for providing ready fuel and material for the construction of cabins, corrals, and fences. Where there are no trees, as over the major portion of the Seward Peninsula and along the Arctic coast, it is sometimes difficult to obtain construction material and fuel for camp use, especially on winter ranges. Thickets of tall willows along rivers and creeks are often a saving factor, and lignite provides a convenient fuel in a number of places. Along the coast, beach driftwood is an important source of fuel and building material, and in the Wainwright and Barrow sections temporary winter corrals are sometimes made of ice cakes.

RANGE TYPES

Classified according to physical character of land and soil, the three main types of range are: (1) The dry tundra; (2) the wet tundra; and (3) the rocky areas. In terms of relative carrying capacity, both as to forage composition and nature of ground, these types vary greatly. The dry-tundra and the wet-tundra ranges may run about equally high in average forage production, but because of greater variety of forage and firmer ground, the dry tundra will probably stand heavier grazing. Because of the reduced forage growth, the rocky type ordinarily has a lower carrying capacity than either of the others.

FORAGE COVER

The plant cover along the Bering Sea-Arctic coast is practically uniform throughout, the relative proportions of the various species

and their density varying, however, with exposure and other conditions (figs. 8 and 9). The vegetation comprises a mixture of lichens, shrubs, sedges, weeds, grasses, and mosses. On the summer range, sedges and species of browse predominate, and on the winter range, lichens and shrubs. Vegetation along the coast is luxuriant, especially on flats, benches, and lower slopes. Hummocky ground of

B33911; B32500

FIGURE 8.—Types of forage: *A*, Tundra cover, chiefly cotton sedges and low shrubs, typical of the immediate Bering Sea coast range; *B*, lichen cover in the interior (chiefly *Cladonia alpestris*).

moist to wet soil (called tundra, or "niggerheads") predominates on the lower elevations, and a dry, generally rocky ground occurs on the upper slopes and the tops of ridges. The vegetation of the treeless tundras is dense, often matted, and profuse. On the upper slopes and tops of ridges it is less dense and becomes dwarfed. On small areas of sandy soil, as along the beach or in forested areas along streams, the grasses and weeds frequently attain a height of 3 or 4 feet. Thickets of tall willows are often found

along stream courses; scattering stands of alders and birches frequently occur on upper slopes or, mixed with spruces, in the larger river valleys; and a mixture of low shrubs, as ground birch, ground willow, blueberry, salmonberry, cranberry, crowberry, and Labrador-tea, grows abundantly throughout the ranges. Grasses are of only scattering occurrence. Sedges, shrubs, and lichens form the bulk of the vegetation.

B33911A; B31115

FIGURE 9.—Types of forage: *A*, Browse of ground birch and lichens, typical of much of the interior mountain range; *B*, woodland cover of birch trees, with a heavy undercover of grass and weeds.

In the wooded interior, shrubs and lichens predominate on the upper slopes, and grasses in the valleys. Up to about 4,000 or 5,000 feet altitude a dense cover of vegetation occurs; between approximately 5,000 and 6,000 feet the rocky nature of the soil supports a cover of lower density; while above 6,000 feet the ground is perpetually covered with snow. Around lakes and along streams up to 2,500 or 3,000 feet elevation the principal type of vegetation is spruce,

with browse-grass and browse-lichen subtypes. This type blends into the open browse-lichen and browse-grass types, which extend up to an altitude of 3,800 or 4,000 feet. Above 4,000 feet a nearly pure lichen type begins and continues up to snow line, at 6,000 feet. Up to 3,000 feet elevation the conifers grow in open patches, but above this they are small (2 to 3 inches in diameter) and scattering. The shrubs, of which ground birch is the most abundant, often occur in dense patches, chiefly on comparatively dry, gravelly soil. Willows grow on the more swampy areas and along stream courses. Alders are found in patches above timber line. Of the lichens, species of *Cladonia* are most abundant. On the river bars and the lower benches of the main drainages, grasses and weeds form the principal growths, grasses often being the main vegetation on lower, southern exposures.

LICHEN GROUPS

The lichens occurring on reindeer range may be divided into two major forage groups—tall growth and short growth. The former comprises the fruticose (shrublike) lichens of taller and erect growth, including most of the reindeer lichens (*Cladonia*) and the iceland lichens (*Cetraria*); the short growth includes the low-growing foliaceous (leaflike) and crustaceous (crustlike) lichens, such as the shield lichen (*Peltigera*), scale lichen (*Parmelia*), and lung lichen (*Lobaria*), and the low-growing or trailing forms of the fruticose lichens (as *Cetraria nivalis*, *C. hiascens*, *Cladonia bellidiflora hookeri*, *C. gracilis dilatata*, *C. degenerans*, *C. decorticata*, *C. crispata*, and *C. gracilescens*), the hair lichen (*Alectoria*), the sand lichen (*Stereocaulon*), and others. The tall growth occurs chiefly on moist tundra, the short growth on drier, well-drained ground. Tall-growth lichens, the more abundant and seemingly the more palatable, make up the bulk of the lichen forage eaten by reindeer. The low-growing lichens, however, are of high value because of their considerably higher protein content. Although they produce a smaller quantity of forage, their quality tends to make them of more nearly equal value as food.

LICHEN ANALYSES

The protein content of a number of common tall-growth lichens analyzed by the Bureau of Chemistry and Soils of this Department averaged 1.9 percent, whereas that of some common short-growth lichens averaged 4.68 percent. The short-growth lichens have also a somewhat higher percentage of fat and ash than the tall-growth lichens have; the latter, however, have more fiber. Table 1 gives the results of analyses made of lichen samples collected in the interior of Alaska. The protein percentages represent averages with duplicate analyses.

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TABLE 1.—*Analyses of samples of lichens collected in the interior of Alaska*

TALL-GROWTH TYPE, OR MOIST-SITE LICHENS

Sample	Moisture	Fat	Fiber	Protein	Ash	Nitrogen-free extract
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Cetraria cucullata	12.22	8.70	9.42	1.75	1.27	66.64
C. islandica	11.85	2.08	8.53	3.13	1.89	72.52
Cladonia alpestris	12.35	1.92	43.98	2.13	2.33	37.29
C. amaurocraea celotea	12.61	1.55	35.68	1.73	1.48	46.95
C. a. oxyceras	11.88	1.78	33.56	1.50	1.39	49.89
C. sylvatica (light form)	12.66	1.45	31.98	1.75	1.81	50.35
C. sylvatica (dark form)	13.02	0.57	44.64	1.50	2.05	38.22
C. s. sylvestris	12.93	1.08	48.92	1.67	1.59	33.81
C. rangiferina	12.83	0.69	47.19	1.75	1.78	35.76
C. uncialis	12.89	1.23	37.26	1.50	1.78	45.34
C. gracilis	12.46	0.85	45.72	2.50	1.79	36.68
Average	12.52	1.99	35.17	1.90	1.74	46.68

SHORT-GROWTH TYPE, OR DRY-SITE LICHENS

Cladonia gracilis dilatata and *C. bellidiflora hookeri*	12.15	0.89	33.27	3.50	2.92	47.27
C. gracilescens	13.27	0.56	40.08	3.06	2.64	40.39
C. degenerans	12.90	0.76	58.29	3.56	2.21	22.28
C. decorticata	13.04	1.14	40.15	4.25	6.27	35.15
C. crispata	12.56	1.34	43.70	2.25	1.85	38.30
Cetraria hiascens	14.13	5.23	11.18	2.94	1.90	64.62
C. nivalis	13.72	4.27	8.26	1.87	2.69	69.19
Dactylina arctica	13.12	5.94	8.52	2.81	2.54	67.07
Stereocaulon tomentosum	12.66	1.94	27.32	5.44	2.09	50.55
Peltigera spp	13.41	1.12	21.93	17.12	7.91	38.51
Average	13.10	2.32	29.27	4.68	3.30	47.33

ANALYSES OF OTHER FORAGE

For comparison with the lichens, analyses of samples of other fall and winter forage are given in table 2. Specimens were collected during the first part of December.

TABLE 2.—*Analyses of samples of certain fall and winter forage other than lichens*

Sample	Moisture	Fat	Fiber	Protein	Ash	Nitrogen-free extract
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Eriophorum callitrix (cotton sedge)	6.86	1.60	34.84	3.69	2.81	50.20
Salix fluviatilis (red willow)	8.41	2.24	15.74	9.63	3.45	60.53
Chamaedaphne calyculata (leatherleaf)	6.10	9.80	23.33	6.25	1.93	52.59
Average	7.12	4.55	24.64	6.52	2.73	54.44

RANGE MANAGEMENT

Throughout the year reindeer are grazed on the open range; even in winter they are not fed on cultivated forage. Each herd is confined to an individual area, comprising a natural topographic unit, on which animals may be controlled reasonably well without undue straying or mixing with other herds. Each unit includes summer and winter ranges and fawning grounds for the individual herd, together with buildings, corrals, and other improvements. Reindeer grazing is localized, and the tendency is toward the maintenance

of permanent units, made possible by the abundance of forage and the presence of large areas capable of being divided into individual grazing allotments, each complete in itself. A system of fixed allotments has therefore been adopted, and assignments are made by lease or permit to individual reindeer owners under provisions of the Alaska Grazing Act, administered by the Department of the Interior. Supervision of the Eskimo reindeer herds was formerly in the hands of the Bureau of Education, but in 1929 this work was transferred to the Governor of Alaska, and in 1931 an executive reindeer council was established, consisting of the Governor and four others.

The suitability of range for reindeer depends principally upon climate and forage, and to some extent upon topography. Since the natural habitat of these animals is in the Arctic and subarctic regions, they will undoubtedly do best on ranges falling within these climatic zones. Whether they can be grazed successfully farther south is not definitely known. The area selected for grazing should lend itself to efficient herd management throughout the year. It should comprise a natural grazing unit, including spring, summer, fall, and winter ranges. In heavily forested country, reindeer are difficult to herd successfully; on unfenced areas this is a factor to be considered.

The value of different kinds of forage plants varies greatly with the stages of growth, the variation in the associated plant species, and the tastes of individual animals. As a rule, reindeer prefer green vegetation and fresh growths and are fond of variety. They feed on a great number of range plants, but in winter they graze especially on lichens and in summer on shrubs, sedges, weeds, and grasses.

CLIMATE

For winter grazing in the Arctic region the range selected must have available an area not subject to periodic crustings of snow. Because of winter rains, even within the Arctic Circle, certain areas near the coast are subject to crusting, and under such conditions herds may suffer great losses through starvation, since the animals cannot paw through hard crust to get food. When such a crust forms, the herd must be moved back promptly to protected areas in the interior hills.

Under ordinary conditions the depth of snow on coastal winter ranges does not seriously affect grazing, since at least part of the area is generally exposed to the winds and does not become deeply covered. In the interior, however, particularly in timbered flats and bench-land country, there is less drifting, and the depth of snow affects the selection of winter range. Where there is much drifting, certain areas may become so deeply covered that the animals cannot paw through to the vegetation. Ordinarily, to reach the lichen forage they will readily paw through as much as 2 feet of packed snow and 3 to 4 feet of loose snow.

WATER

Water is a requirement of reindeer at all times, though the animals eat snow during winter, usually from the middle of October to the middle of April. In the first part of October, between freeze-up and the first snow, there is frequently a period of 10 days or 2

weeks when little or no water is available to the animals. During this period they often go without water other than that obtained from vegetation. Lichens are particularly sought at this time because of their greater moisture-holding capacity. When forced to subsist almost wholly on dry herbaceous and shrubby vegetation, such as sedges and willows, the animals become very restive and lose in weight.

FORAGE

Reindeer and caribou are essentially browsers where an abundant shrubby forage occurs, but in winter, when much snow is on the ground, they seek lichens. Where shrubs are plentiful, 50 percent of their food may consist of browse species. Where other forage is more abundant, as sedges are on the coastal tundra, there will be a smaller proportion of browse in the diet. Willow is particularly liked by reindeer. In the spring, where abundant, the new growths of grasses and weeds are taken to a considerable extent, but later in the season the grasses become less palatable. Lichens are eaten in summer, when available, but are not essential; in fact, reindeer do best without them in summer and early in fall. Late in fall, however, some lichen forage is desirable. Animals may be successfully carried during fall either on lichen forage or on the natural-cured herbaceous and shrubby vegetation, but for maintenance in the best condition, there should be a mixture of both types.

A desirable combination for late-fall and early-winter pasturage consists of about 25 to 50 percent of lichens and the remainder of dried herbaceous and shrubby vegetation, such as cotton sedge, horsetail, fireweed, and leaves of willow, blueberry, ground birch, birch, alder, and cranberry. Mosses also are eaten to some extent in fall, winter, and early spring. Aspen, currant, and cranberrybushes are unpalatable. During the main winter period, December 20 to April 8, a lichen forage is necessary. Desirable forage at this time consists of 75 to 90 percent lichens and other vegetation, including mosses.

SITE

In Alaska, because of the peculiar physical and climatic conditions and the scattered population, a careful selection of range site is especially important. Convenience to transportation facilities or to mining camps and villages is desirable in order that labor, supplies, and equipment may be accessible, and that shipping and marketing the meat may be convenient. This accounts chiefly for the fact that most of the Alaskan herds are at present on or near the coast, with the greatest concentration at the most accessible points. With improved transportation facilities, more herds will be established in the interior. Accessibility within the individual range area is also a factor to be considered.

The reindeer herder's calendar indicates seasonal and other variations in herd and range conditions and the attention required of the herder. The beginning date of a period is shown in the first column; the date preceding each entry in the other columns indicates the close of the period described. Once familiar with this calendar, the herder will be able to tell at a glance what conditions to expect at any season and what will be required of him.

CALENDAR FOR REINDEER HERDERS

[Beginning dates shown in first column; ending dates for different lines of work shown in other columns]

Period beginning—	Herd condition	Appropriate range	Available forage	Required attention for—	
				Herd	Range
Apr. 8	**To May 1:** Spring break-up; herd still in snow. **To June 22:** Fawning season; caribou run; reindeer bucks on the move. Warble and nose grubs are dropped. Coats are shed. Does drop horns soon after fawning.	**To June 22:** Protected and early area of southerly exposure, bordering winter range, preferably 20 or more miles from summer corral site and chief summer range.	**To June 22:** First fresh-green growth of sedges, grasses, weeds, and browse.	**To Apr. 15:** Move herd to fawning ground. **To June 22:** Hold herd on fawning ground and disturb as little as possible, but go among reindeer so as to accustom them to people. Grubs are dropped at this time; *critical period—watch carefully.*	**To June 22:** Repair corrals for later round-up. Haul supplies to all cabins so herders will not have to pack later. Clean up around cabins.
June 22	**To July 25:** Pest season; mosquitoes and flies most active. **To Aug. 20:** Unmolested by mosquitoes; best feeding season.	**To Aug. 20:** Tundra bordering beach along coast; wind-swept mountain slopes and tops in interior.	**To Aug. 20:** Growing and succulent green plants of browse, sedges, grasses, and weeds.	**To June 25:** Move herd to summer range for corralling; move 20 or more miles from fawning ground and grubs. **To July 25:** Round-up for marking and castration. **To Aug. 20:** Hold herd on summer range, 20 or more miles from fawn-ground. Do not molest.	**To Aug. 20:** Construct herding cabins, fences, corrals, etc.
Aug. 20	**To Oct. 10:** Unmolested by mosquitoes; conditioning period. Meat suitable for butchering. Rutting season; caribou run and reindeer are restless.	**To Oct. 10:** Tundra and lower foothills along coast and mountain slopes and tops in interior.	**To Oct. 10:** Mature and drying shrubs and herbs, mushrooms, and some lichens.	**To Aug. 25:** Second round-up, if needed, for castration and cutting out butcher or feeder stock. **To Oct. 10:** Hold herd on summer or fall range, on ground that is not rough; *critical period—guard carefully* against straying.	**To Oct. 10:** Gather lichens for later hauling to camp for feeding sled deer. Repair sleds and harness in readiness for use of sled deer.
Oct. 10	**To Oct. 15:** Freeze-up; water scarce; herd restless and on move. **To Dec. 20:** Animals in good condition if on proper range. Meat suitable for butchering.	**To Dec. 20:** Middle benches and foothills, or belt between summer and winter range.	**To Dec. 20:** Natural-cured sedge, hay, and leaves of browse with available lichens make a conditioning fall feed.	**To Oct. 15:** Drift onto fall range; *critical period—guard carefully.* **To Dec. 20:** Round-up as desired for butchering stock. Hold herd on mixed browse, sedge, and lichen range—off main winter lichen range.	**To Dec. 20:** Select choice animals for sled reindeer and break to drive. Haul lichens to camp and supplies and equipment to winter camps. Build cabins.
Dec. 20	**To Apr. 8:** Period of quiet; herd localized.	**To Apr. 8:** Inland hills of the coast belt; lower, timbered slopes and valleys in interior.	**To Apr. 8:** Lichens, chief winter feed; not fattening and should be regarded mainly as held-over forage for winter use.	**To Feb. 15:** Round-up for separating herds that have mixed. **To Apr. 8:** Hold herd on main lichen range, which should be conserved for this purpose.	**To Apr. 8:** Haul supplies and equipment to various camps and store for spring and summer use. Cut and haul materials for cabins and corrals. Make sleds, harness, etc.

SEASONAL USE OF RANGES

Reindeer ranges must be so stocked as to insure adequate food from year to year, and they should be divided into seasonal areas to afford the best feeding during each season. The seasonal grazing periods in Alaska (see calendar for reindeer herders, p. 19) are as follows:

Spring and early summer: April 8 to June 22.
Summer: June 22 to August 20.
Fall and early winter: August 20 to December 20.
Winter: December 20 to April 8.

These periods are determined by differences in climatic conditions, forage utilized, and responses of the animals. The best plan, therefore, is to divide the range into four units—one for spring and early summer, one for summer, one for fall and early winter, and one for winter. By such a division, based on the seasonal needs of the animals and on the forage, and by thus distributing the grazing more evenly over the range, the reindeer raiser will be able to maintain forage under heavier grazing and to reserve sufficient for the most critical periods of the year.

SPRING AND EARLY SUMMER

In spring, when fawns are dropped, usually during May, and the herd divides—the does grouping by themselves for fawning and the males roaming elsewhere—the forage sought consists largely of the young shoots or flowering stalks of cotton sedges and of grasses and weeds. Reindeer are fond of fresh green growth, and in grazing on the hummocks miss few of the new shoots. At this season they feed also upon willow buds, lichens, and Labrador-tea.

In selecting the fawning range, two requirements in particular must be borne in mind: (1) Ample green food, so that the does will produce sufficient milk for the fawns; and (2) protection against severe storms. A fawning range should have as good natural protection as the topography and surface cover allow, especially in the way of coves and hollows, and patches of brush or timber. Low altitudes with exposure favorable for the early growth of vegetation offer the most desirable fawning grounds (fig. 10).

Since reindeer return year after year to the same fawning ground, it is important that a suitable selection of spring range be made for the purpose and that the area be used only at that season. Grazing on plants just beginning new growth in spring is of course injurious, and only strong, vigorous plants that have stored considerable food material in their roots during the growing period of the previous year can withstand it. Accordingly, the herd should be moved just as soon as possible after fawning so that the plants will have an opportunity to recuperate. If the reindeer are thus grazed on the fawning area in spring only, the forage will grow sufficiently each summer to insure early, vigorous plants the following spring.

As warble grubs are dropped from the backs of the reindeer at fawning time the ranges should be so situated that the herd in summer will be at least 20 miles from the fawning grounds, where the grubs were dropped. This will tend to prevent infestation by warbles, since the flies upon hatching apparently do not travel any great distance. Upon leaving the fawning ground, the reindeer are

usually driven to the corrals for marking. The corrals also should therefore be 20 or more miles from the spring range.

SUMMER

In early summer reindeer are much harassed by flies and mosquitoes. Their feeding is interrupted, and they seek shelter on wind-swept areas (fig. 11), on glaciers, and in water. Late in summer,

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FIGURE 10.—Reindeer on fawning range.

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FIGURE 11.—Herd of reindeer on summer range.

however, the animals are unmolested by insect pests and rapidly gain in weight. This is the best feeding period, the conditioning acquired continuing through fall and early winter.

The chief requirements for summer range are protection against flies and mosquitoes and abundance of shrubby and herbaceous vegetation. The wind-swept beach areas provide shelter from insect pests

along the coast, and the mountain tops afford protection in the interior.

During summer, reindeer feed on a great variety of range plants, but principally on shrubs and sedges. At the beginning of the season, in addition to their main food of sedges and willow browse, they feed extensively on the succulent young grasses and on such herbs as fireweed, horsetail, fernweed, groundsel, wormwood, and parsnip. In middle and later summer they feed mainly on sedges, various shrubs, lichens, mushrooms, and the more succulent herbs, and to some extent eat the mosses that are mixed with other forage. Lichens in summer are dry and brittle and for this reason are both undesirable as forage and easily destroyed through trampling. The nonlichen range should therefore be chosen for summer grazing and the lichen areas reserved for winter.

FALL AND EARLY WINTER

When the summer forage reaches maturity and becomes somewhat dry and the leaves begin to fall, reindeer become restless and tend to wander in search of mushrooms and lichens. They feed then largely on fallen leaves, on dried shrubs and herbaceous vegetation, and on lichens. During the mating season, a range of fairly even surface is desirable to lessen the chance of accidents.

A freeze-up usually occurs during the first part of October, and snow covers the ground the latter part of the month. There is, however, only rarely a heavy covering of snow before the middle of December or later. During this period of light snow the reindeer feed on a mixture of lichen and nonlichen forage. Experimentally, animals have been successfully carried on nonlichen range at this time. A mixed forage is preferable, however, and the most desirable fall and early winter range is one abundant in shrubby and herbaceous vegetation with a 25- to 50-percent mixture of lichens. On such range the reindeer will maintain their prime fall condition and be suitable for slaughtering up until Christmas.

During fall and early winter special efforts must be made to keep the animals from drifting immediately onto the main winter lichen areas, which are needed when considerable snow is on the ground and should be retained for such use. Furthermore, reindeer lose in weight on lichen forage alone, but they gain on a mixed forage, and therefore should be held on the fall range as long as possible.

WINTER

During the main winter period of heavier snow, a lichen range is essential. At this time, where there is sufficient forage reindeer do not move around much. In the coast belt, the best winter-range areas usually lie 30 to 40 miles inland. Ranges close to the coast are undesirable for winter use because they may be subject to periodic crusting.

The diet in winter consists almost entirely of lichens, which the animals find underneath the snow by their sense of smell and uncover by pawing. Of the forage lichens, the species of *Cladonia* are the most important because of their high palatability and great abundance. The species of *Cetraria* and *Stereocaulon* are also palatable but less abundant. Dried herbaceous vegetation and such browse as

cranberrybushes are eaten to some extent, and some of the mosses occasionally.

The main lichen areas, as noted before, should be conserved for winter use only and the herd kept off such areas in summer, when the plants have lost their moisture and are easily destroyed by trampling. A depleted lichen range may require 15 to 40 or more years for recovery.

GRAZING CAPACITY

The grazing capacity of a range is the number of animals that can find sufficient palatable forage on it during the season it is used, year after year, without injuring the plants. So many varying factors affect the grazing capacity of every range that even a carefully allotted area should be watched at all times and the number of animals continually adjusted to the available forage. The carrying capacity of a winter range depends on a number of factors that do not affect a summer range, and for this reason greater care must be taken in ranging the animals during winter, as is indicated in the following paragraphs.

Lichens, which constitute the principal winter food of reindeer, differ from the shrubby and herbaceous summer vegetation in nature, in habits of growth, and in reaction to injury. They are slow growing, are easily injured by trampling when dry, and require several years to attain mature growth. In Alaska the average height is 4 to 5 inches, the maximum, 10 inches. Because of these differences greater care must be taken to avoid destroying the individual plants on a grazed lichen area or checking their continued healthy growth and reproduction.

The inland winter areas and high country generally are not so well covered with vegetation as the summer areas lying along the coast or in the lower foothills. Much of this top country is almost barren in places, and on large areas the lichen growth is only of patchy occurrence. In some cases only a third or a half of the total winter range may be available for grazing. The average summer range, on the other hand, is usually of full cover, and the total area is available for grazing. To provide sufficient forage for winter grazing, a greater acreage, therefore, is required.

The fact that reindeer usually remain in one general locality throughout the winter results in closer utilization of the forage and in greater danger of overgrazing. To offset these conditions an acreage within the winter-grazing area must be provided which will be large enough for a scheme of deferred and rotation grazing to be put into effect.

RANGE REQUIREMENTS PER ANIMAL

Studies of carrying capacity made by pasturing reindeer under fence at the Reindeer Experiment Station thus far indicate that on an average range 33 acres is the minimum year-long grazing-area requirement for each reindeer. The seasonal requirements per animal on this minimum basis are as follows:

Spring and early summer (2½ months)	4 acres
Summer (2 months)	2 acres
Fall and early winter (4 months)	10 acres
Winter (3½ months)	17 acres

On open range, however, preliminary stocking should be on about a 45-acre basis. Continued inspection may then determine the degree of utilization possible, and whether further increases in the herd can safely be made.

RANGE REACTION

A specific study of range reaction to fire and grazing is being made by the quadrat method. These investigations have not progressed far enough, however, to warrant more than general observations.

Certain ground conditions have undoubtedly been built up gradually during recent geological periods and maintained through the protection given by an undisturbed cover. The climate, however, has so moderated since glacial times, that when the cover is disturbed by plowing, mining, burning, grazing, or by other means, a marked change is likely to take place. Thus, where a heavy sphagnum-moss and lichen forage in spruce climax has been built up (the moss bed perhaps 3 to 4 feet deep), the thick mat prevents the ground from thawing. Upon disturbance, the protection is removed, the ground thaws more rapidly, and the new set of conditions results in the growth of a different cover. The spruce climax will still hold, but the undercover will tend to change in character, the moss often giving way to shrubs, grasses, and weeds. In other cases the moss is replaced by a greatly mixed cover, including numerous lichens of the short-growth type, particularly *Cladonia bellidiflora hookeri*, *C. gracilis dilatata*, *C. coccifera*, and species of *Peltigera*.

Removing moss and lichens on tundra seems to make way for sedges and grasses. Over much of the Alaskan range disturbances tend to reduce the available soil moisture, and the trend therefore is toward replacement of moisture-loving plants by drier-site plants. Fire causes a marked disturbance, particularly when it eats below the surface of the ground, into heavy humus, sphagnum mat, or a peaty soil. Where there is a sheet of ice 3 to 4 feet below the tundra surface, as is often the case along the Bering Sea and Arctic coast, or in the valleys of the interior, disturbance by grazing, fire, mining, or water action may thaw this ice, making the soil cave in and changing the subsequent cover.

When reindeer were first introduced into Alaska, the immediate coastal areas contained a considerable cover of lichens. In these areas lichens have now largely disappeared, owing probably to the earlier close confinement of the herds to the coast. The new cover consists almost entirely of herbaceous and shrubby vegetation—sedges, low species of browse, and grasses. On some other ranges similar changes due to grazing and fire may be expected—changes that on the whole will probably prove beneficial to summer pasturage but detrimental to the maintenance of winter forage. The injury, however, may be reduced to the minimum through the avoidance of overstocking the winter areas and through protection against fire.

The summer-range forage plants, chiefly grasses, sedges, weeds, browse, and other herbaceous and shrubby vegetation, are eminently suited to grazing. They are highly organized seed-bearing plants of strong tissue and are firmly rooted. Most of the Alaskan species are perennial, reproducing both vegetatively and from seed. They grow rapidly, produce substantial foliage, are not readily injured by grazing, and so supply an annual forage crop.

Lichens, on the other hand, differ from the herbaceous and shrubby vegetation in character and in reaction to grazing. They do not furnish a renewed forage crop from year to year, but require a long period to recover from one season's cropping. They are not seed-bearing plants, but reproduce by means of spores, or vegetatively from fragments of old plants. Although lichens attain great age, they are of low and slow growth. They are comparatively delicate in structure, not firmly anchored to the soil, and are easily destroyed either by trampling or cropping, particularly under summer conditions, when they often become dry and brittle. When moist or wet they are almost spongy in texture and less easily injured.

Lichens spread and increase rapidly, reproduction and growth occurring whenever there are favorable conditions of high moisture, usually in spring and fall. In a wet season the plants may continue to grow throughout the summer; but ordinarily the summers are dry and hot, and the lichens then lose their moisture, become brittle, and stop growing. Growth may continue into the winter, also, in sheltered, rocky situations where the action of the sun on the frozen surface makes the ground moist.

As a rule, lichens spring up the first year after the ground has been denuded of forage, the plants coming in best where the ground has been cleared of the matted growth, giving them a chance to begin their development. Where the top of the plant is cropped, offshoots generally result in a bushy, deformed top. By killing a large part of the growing plant, cutting or cropping the lichen cover causes considerable damage. Even light cropping or trampling may result in much damage, and heavy trampling in summer when the plants are dry and brittle may kill all the lichen cover. Winter ranges must, therefore, have complete protection from grazing during the late spring, summer, and early fall—particularly when the surface is thawed and the lichens are dry and brittle. During the winter, on the other hand, the lichens again have a moist consistency, and the ground is frozen together with the base of the plant, thus affording considerable protection against ready destruction.

Quadrat observations made on the coastal tundras indicate that recovery of lichen range following full cropping may take possibly 15 or 20 years. On higher ground, where a dry, rocky soil offers less favorable conditions for good growth, recovery undoubtedly will take much longer—perhaps as much as 25 or even 40 years. The rate of recovery of a lichen range depends much on the site. Further information on forage plants is contained in Department of Agriculture Bulletin 1423, Progress of Reindeer Investigations in Alaska.[3]

HERD MANAGEMENT

Management of a reindeer herd is closely associated with management of the range; in fact, the two together determine whether there will be a gain or a loss in animal production.

SIZE OF HERD

A fairly large number of reindeer can be handled more easily and economically than a small number. In rounding up and driving,

[3] For sale by Superintendent of Documents, Government Printing Office, Washington, D.C., at 15 cents a copy.

a herder can best handle about 5,000 animals without losing parts of the herd. In Alaska the herds number from a few hundred to several thousand, the average being about 7,000. Because of the large natural grazing units and the impracticability of dividing the range among numerous small bands, the tendency is toward large herds. Increase in herd size, however, is limited by the carrying capacity of the individual allotment. The size of an allotment is governed, of course, by its natural boundaries, but most of the local units have a carrying capacity of 5,000 to 10,000 reindeer, or an average of 7,500. Maintenance of such large herds is made possible by the practice of open herding, and would be impossible under close herding.

HERDING METHODS

Reindeer are herded much as cattle are on the large western ranges, the herders following the animals as they move about over the range. Reindeer have definite range habits and seasonal movements, but influenced by weather conditions, especially winds, they may at any time move from one part of the range to another. By

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FIGURE 12.—Herding reindeer near the beach.

learning these habits, however, the herders are able to judge fairly well where the herd may be found at a given time.

Open herding as practiced in Alaska consists chiefly in making a big circle around the herd each day and working in the few strays that get too far away from the outer grazing circle. This is done with as little disturbance of the reindeer as possible, thereby maintaining a more natural and widespread grazing on the range area used. Although the reindeer are thus allowed to spread loosely over the range, open herding must not be thought of as implying lax methods, in the sense of turning the animals loose to wander over the country at will, to be herded only at intervals. Unless the herd is constantly watched, losses are sure to result through straying.

Herding is now done entirely on foot, mainly by Eskimos and Lapps, with the aid of dogs (fig. 12), 1 or 2 herders going out each day from a central camp to watch the herd. Numerous camps are scattered about over the range, and the herders move from camp to camp as the seasonal shiftings of the herd require. The present practice on the best-managed ranges is to construct cabins for permanent use, where supplies and equipment can be stored conveniently. The ideal arrangement is to build these cabins near enough together

for a herder on any part of the range to be within a day's walk of a cabin and to place them so as to facilitate the patrol of the range boundaries.

For hauling supplies to the camps, sled reindeer and dog teams are used in winter; in summer, transportation is largely by boat and on foot. Recently, the airplane has been used to some extent for this purpose.

ROUND-UPS

Reindeer are rounded up each summer—late in June or early in July—to be marked and counted, and again in the fall or early winter—October, November, or December—to be butchered. Round-ups may also take place late in August, for castrating and for cutting out butchering or feeder stock, and also in January or February, for separating mixed herds or for castrating. Formerly, when the herds were small, reindeer in round-ups were handled by roping, either on the open range or within a crudely constructed enclosure of brush or poles. With large herds, however, roping is impracticable, and the handling is done through a chute.

In preparing for round-ups, usually 6 to 10 herders scour the range for stock. Each man goes on foot, accompanied by a dog. As he must pack his own provisions, he cannot stay out on the range more than about 10 days. The men work separately, each herder camping where night overtakes him. Sometimes the herder is fortunate enough to reach a cabin at which to stop, but more often he sleeps out by a camp fire under a tree or on the open tundra. As soon as any reindeer are located, they are started in a common direction and kept moving toward the corrals until gradually all are brought together. The total herd, which may often number 5,000 or more, is then grazed within a mile or two of the corrals at night and held closer in during the day until the completion of the work.

Some scouting experiments have been carried on with airplanes to locate animals for the round-up. Reindeer are readily located from the air, and it is reported that the approach of a low-flying airplane will startle them to such an extent that they will run together and bunch. Thus, the airplane may sometime prove to be of much value in round-ups.

Small bands of 1,000 to 2,000 animals are separated from the main herd from time to time as required for handling. Often, while the herd is awaiting corralling, small bunches escape at night into the hills. For this reason, in a number of instances, reindeer owners have fenced large pastures adjoining the corral in which to hold the herd during the round-up. These fences are constructed of 5-foot wire netting or of horizontal poles, usually laid a foot apart.

CORRALLING

A corral and such other improvements as are necessary for handling the individual herd are constructed on each allotment or range unit. The corral is usually built on a sand spit on the coast or on a well-drained knoll. On some allotments it includes pasture. There are two types of corral, the more common one, in which a chute (fig. 13) is used, and the other, in which a central pen is used.

To construct the corral, heavy spruce posts are first set in the ground and then joined at the top by cross poles approximately 5

feet from the ground. Split spruce poles 7 feet long are then nailed against the cross poles about 2 inches apart, upright, with a slight outward slant, and the lower ends sunk a few inches into the ground. The completed corral wall presents a palisade effect. Instead of having a regular gate, a portion of the fence is made movable at a place where the animals can be driven in.

The main enclosure, into which the animals are first driven, is circular, 50 to 75 yards in diameter, large enough to hold the number of reindeer that can be handled in 1 day's work—2,000 to 2,500. Nothing is gained by making the corral larger; furthermore, in large corrals it is more difficult to handle the animals when driving

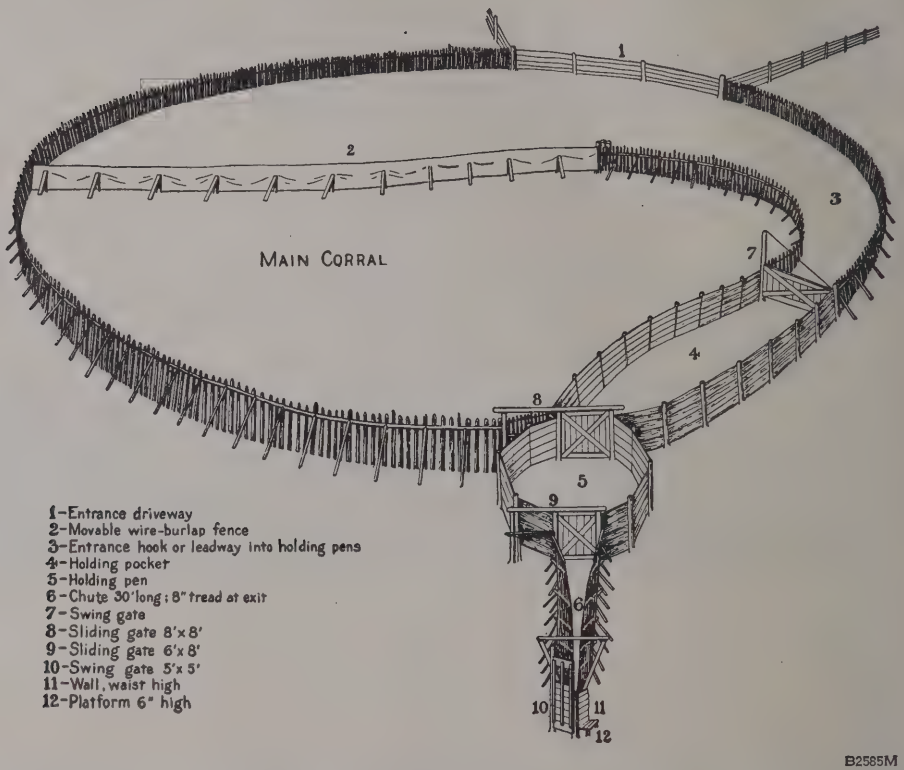

FIGURE 13.—Highly successful corral of the chute type. It is important that the leadway into the holding pens be constructed on the side of the corral to meet the direction in which the herd mills. The movable wire-burlap fence is useful in cutting off bunches of stock from the main herd.

them into the pockets. A swinging gate at one side leads into a pocket about 10 yards wide, into which the animals are directed by a wing or hook extending into the large enclosure from one side of the gate. At the far end of the pocket a sliding gate opens into another pocket almost as large, and at the far end of this pocket a second sliding gate opens into a narrow V-shaped chute, 15 to 30 feet long. At the outer end of this is a swinging gate, opposite which is a low platform fronted by a wall waist high.

Where the herd is large and there is no fence for holding the animals during the round-up period, a second corral attached to the end of the chute becomes necessary. This corral should be about the same size as the main one. As fast as the animals are handled

hey are turned into this corral to be held until the day's work is ompleted. The bunch is then turned out and driven far enough way to prevent its mixing with the main herd or with those not yet narked. Some mixing, however, is bound to take place when does eek their offspring or fawns their mothers. Consequently, as each nimal passes through the chute, its side is marked with paint (yel- ow or green, for example) in order to avoid recounting. As fawns re freshly ear-marked, they need not be painted.

DRIVING INTO CORRAL

In corralling, a small band is quietly separated from the main herd early in the morning while the reindeer are grazing and more or less scattered. Does are thus less likely to become separated from their fawns. The small herd is then driven to the corral.

Though more or less like cattle in habit of grazing, when being driven reindeer bunch like sheep and drive almost as readily, except for a tendency to mill. Where one goes the rest follow. When crowded they start to mill, though they do this very little when moving along in the open.

Wing fences extending out from the entrance of the main enclosure serve to direct the reindeer into the corral. Preferably the entrance driveway should lead upward into the corral. It is interesting to watch the animals as they are crowded toward the enclosure with a line of herders closing in behind and stretching a long strip of burlap between them to discourage escape. Milling around always in the one direction, all are much excited; the mouths of the older animals are open; they are panting and coughing; there is a rustling of snapping ankles; and intermingling with these come the grunting of fawns and the deeper-toned answering calls of the does. Occasionally, a few animals, generally a doe and a fawn leading, will suddenly break away and dash through the line of drivers. Others may note them and follow, but the main herd remains intact, and the few wandering ones, realizing that they have gone away from the rest, usually soon turn back, the herders opening up to let them in. Sometimes, however, they must be brought back by dogging.

By persistent gradual crowding, done quietly and without excitement, the herd is finally brought to the corral entrance. Much shouting and gesturing may excite the animals and cause them to stampede. The leaders, seeing the corral opening, suddenly dash in, and the rest follow. Two or three sled reindeer tied within and to one side of the corral are most valuable in attracting the herd and inducing it to enter. As the reindeer rush into the corral, the herders run in behind to line up at the entrance, and the gap in the fence is then closed. In the corral the herd continues to mill for some time before quieting down (fig. 14).

HANDLING IN CORRAL

The corralled animals are now put through the chute for handling. A crew of about 20 men is usually employed, including 1 tallyman, 3 men to mark or brand, 2 to castrate, 8 to 10 to throw and hold the animals, 2 on the platform at the end of the chute to catch and pass out animals (1 of these to paint also), 1 gatekeeper at the end of the

chute, and 1 or 2 men tending the pockets. To start work, the gates leading from the main corral into the two pockets are opened. Part of the crew then cuts out and drives a small bunch of the reindeer into the pockets, enough to fill them comfortably; then the gates are closed. The men take their stations, the gate leading into the chute is opened, and 2 or 3 animals are driven through, those that remain

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FIGURE 14.—Reindeer herd in corral.

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FIGURE 15.—Handling reindeer at the end of the chute.

in the pocket being held in check. The gatekeeper at the outer end of the chute opens the gate, and the animals, seeing a way of escape, rush for freedom. The gate is closed just before they reach it. A man on the platform seizes each animal, holds it by the horns, and then passes it singly, to the handling crew outside. There the reindeer is thrown and marked or castrated, or both (fig. 15). Animals that have previously been marked are merely recorded by the tallyman and allowed to pass through without being caught.

As the one working in the pockets regulates the passing of animals into the chute, the speed of handling depends to a large extent upon him. Each time the chute is emptied he drives another 2 or 3 animals into it, repeating the process until the pocket is emptied. He then closes the gate to the chute while driving more animals in from the other pocket. Work is further facilitated by his calling out the age and sex of the animals passing into the chute to let the handling crew know what is coming. Animals may be handled under this method at the rate of 300 or more an hour.

One man stationed at the end of the chute, either the gatekeeper or one on the platform, is detailed to call out ownership, age, and sex of animals as they pass through. He should be the best informed on the various earmarks or brands in the herd. The tallyman records all animals by ownership, sex, and age as they are called out and also directs to whom unmarked animals shall be allotted.

As the reindeer pass out of the chute, they are successively grasped by the horns by the men standing in line outside waiting to receive them. Yearlings are thrown by grasping the near horn in both hands, the left hand being placed near the end, the right holding a prong nearer the head. The animal is twisted over on its right side as it struggles. Fawns are grasped by a horn with one hand and by a flank with the other. As they are lifted their feet are thrown from under them and they fall on their side.

One man alone throws a yearling or fawn, but the larger, older reindeer must be handled by more than 1 man, usually 3. As one of these animals reaches the end of the chute it is grasped and held by the horns by a man on the platform, the near horn being used as a lever over the low wall fronting the platform. The gate is then opened, and another takes the animal by the forelegs. The horns are pulled over the end of the chute by 2 men, the animal twisted over and thrown on its side and dragged a few feet away, where it is held by another. A dehorned animal is thrown and held by placing the chest against its side, grasping its off front leg, and, as the animal goes over, placing one leg over its back and the other between its hind legs.

MARKING FOR OWNERSHIP

Reindeer are marked to indicate ownership by cutting or notching the ears. In some cases a metal ear tag, or button, also is used. Each owner is required to register his mark or brand with the Territorial Secretary.

BASIS OF DISTRIBUTION

Unmarked stock is distributed among the owners on the basis of percentage ownership of does, including female yearlings. When there is no definite record of ownership, proportionate distribution is made on the basis of the marked does passing through the chute. Once the ownership within a herd is completely established, the marking of fawns from year to year is done on the basis of percentage ownership the previous year, with transfers taken into account. As unmarked yearling females are assigned, they add to the total female stock of the owner and to his share in the distribution of the fawns.

The percentage on which distribution is based is found by dividing the total number of fawns by the total number of does. The

number of fawns to which each owner is entitled is found by multiplying this percentage by the number of does recorded for him. A second method of reaching the same result, and often preferred, is to divide the total number of does of each owner by the total number of does in the herd, and then multiply by the total number of fawns.

MARKING STRAY ANIMALS

When stray animals from adjoining herds pass through the chute, fawns are marked to their owner on the basis of 40 to 50 percent of the stray does handled, the rate depending upon the percentage of herd increase. Owners of strays do not, however, share in any unmarked yearlings—these are marked and assigned only to recognized owners in the herd.

This assignment of strays has now become a general practice in most sections of the Territory. Usually the fawn crop will be more than the 40 to 50 percent, but the difference is considered as the payment for herding and handling the stray animals.

SCORE SHEET FOR PERCENTAGE MARKING OF REINDEER
HERD: NOME, NO. 1
DATE: 8-15-28

OWNER	ADULTS			YEARLINGS		FAWNS	
	DOES	BUCKS	STEERS	FEMALES	MALES	FEMALES	MALES
JOHN DOE	𝍸 𝍸						
	𝍸 𝍸	𝍸 /	𝍸 𝍸	𝍸	𝍸 /	𝍸	𝍸
	𝍸 𝍸		𝍸 ///			𝍸	𝍸
	𝍸 //					//	//
FRED SMITH	𝍸 //	//	𝍸	/	//	///	///

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FIGURE 16.—Sample tally sheet for use in percentage marking of reindeer as they pass through the chute.

PRELIMINARY PROCEDURE

In inaugurating the percentage-marking system, owners should first agree on a definite procedure. They should record on paper a list of all transfers to be made in settlement of debts, payment for herding, or exchanges between owners, in order that the tallyman may make proper account and correctly instruct the markers. It should also be determined, in certain cases, to what owners the unmarked yearlings shall be distributed, and in what proportion. Controversies regarding ownership and payment of herding expenses should be settled, and the final agreement written down for the guidance of the tallyman.

Tally sheets should then be prepared, listing the owners and indicating the approximate number owned by each, so far as known. Columns on the tally sheets provide for recording adult reindeer—does, bucks, and steers; yearlings—females and males; and fawns—females and males. As each animal passes through the chute its ownership is noted, and it is recorded by a check mark on the sheet in the proper column opposite the name of the owner. Greater space

should be allowed on the tally sheet for the record of the large owners, and large and small owners should be grouped separately (fig. 16).

As unmarked fawns or yearlings appear in the chute, the tallyman shouts out to whom each is to be allotted, and a record is made to that effect. To determine what distribution shall be made the tallyman constantly watches his score sheets and assigns ownership of unmarked animals in proportion to the number of does handled. Ordinarily it may be safely estimated that there will be about 60 percent as many fawns as does; in some of the best-handled herds there may be 70 percent.

DISTRIBUTION OF FAWNS

It is comparatively simple to make a fairly close distribution of the fawns among owners as the work progresses, though it is impossible to obtain absolute accuracy in distribution. A minimum of long and short assignments, however, may be obtained through careful tallying. Following the handling of the first band or two through the corral a good idea may be gained as to about how many fawns there are—that is, whether 5, 6, or 7 fawns to each 10 does—and subsequent marking may then be kept more closely in balance. In working the last lot through, greater care should be taken and necessary adjustments made to balance the longs and shorts.

The ratio of unmarked animals to does constantly fluctuates as the work progresses during the day, but distribution to conform with this variation is automatically maintained by recording on the basis of does as they appear. For example, if the run through the chute happens to be 10 does to 5 fawns, each owner as he obtains 2 does is allotted 1 fawn; or should the runs be 10 does to each 6 fawns, each owner as 5 does are recorded for him is allotted 3 fawns.

Later, toward the close of each day, totals may be figured and the actual proportion of fawns determined for the entire lot handled, and on the basis of this percentage further recording may be made to balance as nearly as possible the number of fawns assigned to each owner. Longs and shorts may be balanced from time to time as rechecks are made of the percentage of fawns.

When the herd is being handled, fawns often bunch together, and a large number may come through at once, or the fawns may come through early, before a proportionate number of does has been recorded. When fawns appear faster than does, they may safely be marked to large owners in advance, since it is certain that a sufficient number of does of these owners will come through later on. In no case should a larger number of fawns be allotted in advance to small owners than that to which the tally sheets show that they are entitled; nor should they be assigned any fawns until adult females are recorded for them. Early in the marking it is a safe rule never to assign to small owners more than 1 fawn for each 2 does handled (50 percent). Later on, should the percentage run higher than 50, proper adjustments can be made.

Similarly, small owners should never be assigned either male or female fawns ahead. If there should be a heavy run of one sex, although normally the numbers are about the same, and if the owner's quota of that sex should be filled then the surplus should be as-

signed in advance to the large owners only. A balance will eventually develop as the work progresses, particularly toward the close of the marking.

DISTRIBUTION OF YEARLINGS

There are 4 distributions and 4 percentages to be considered. These are the distributions and the percentages of male and female fawns and of male and female yearlings. Each class of reindeer requires a separate apportionment, although, as stated, for fawns the percentages of the sexes will be about the same. Unmarked yearlings are apportioned among the owners in the same way as are the fawns. These include all unmarked animals other than fawns, whether 1 or 2 years old or older.

RECHECKS AND BALANCES

Rechecks should be made at the close of each day's work, if not oftener, and necessary adjustment made at the beginning of the next day. The total percentages at the close of the first day's work should be used in distributing fawns the next day and until a further recheck is made. In continuing the marking the next day, however, a balance should first be effected to check off longs and shorts. The second recheck, for example, may show 60 or it may show 70 percent, but whatever it may be, this new figure should be used for the subsequent marking.

Each recheck should be based on the total number of animals previously handled and not on that particular day's work only. Furthermore, with each recheck the increase due each owner should again be figured from the beginning, and a retabulation of longs and shorts made for further balancing.

Prior to working the last lot of reindeer through the chute a final recheck should be made and a balance of longs and shorts obtained to be carried over for correction in the next year's marking.

DISTRICT MANAGEMENT

A recent development in reindeer management, particularly on Seward Peninsula, is the grouping of herds in well-defined districts under one management. Such district management is desirable where natural divisions between individual allotments or units are so poor that there is excessive mixing of herds. Each district, comprising several units of range, is defined by major natural boundaries within which the several herds of the section may be confined with a minimum of straying. There may be considerable mixing of herds within the district, but the several unit herds, or community bands, are maintained as before, although within each district they are considered and handled as one. Under the direction of a general herd superintendent, or unit manager, in charge of each district, the various herds are handled through a local association of owners. Individual ownership and marks are retained, but each owner within the district, whether an individual, a company, or an association is considered a co-owner of the various herds or bands within the district. This arrangement, under centralized management, permits rotation grazing, obviates the necessity of close herding, and eliminates the great expense required to keep reindeer of several unassociated ownerships from mingling. It also promotes organized butchering and facilitates marketing surplus animals.

CASTRATION

Reindeer are castrated to produce steers (fig. 17) for meat and to reduce the number of bucks to a proper proportion of the herd, only those being retained that are best suited for breeding purposes. Animals may be castrated either as fawns or as adults. The fawn, however, should be at least 2 months old, so that the testicles will be developed sufficiently for ready handling.

The tools needed in castrating are a sharp knife and an emasculator, an instrument shaped like a pair of pliers with a broad corrugated crushing surface and a cutting edge. These should be kept in some good disinfectant when not in use, and instruments and hands should be rinsed in it after each operation.

In castrating, cuts in the scrotum should be made with the knife directly over the middle of each testicle, care being taken to make

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FIGURE 17.—Reindeer steers.

the cuts clear to the end of the scrotum, in order to insure good drainage. The testicles are then slipped out through the separate cuts, and removed by severing the cord fairly close to the abdomen, with about 1 inch of the cord attached to each. In fawns the cord may be cut by scraping with the knife, but in older animals the emasculator should be used.

Special care should be taken to see that the knife used is well sharpened and that good drainage is obtained. Pulling on the testes and cutting the cords with a dull knife may cause a rupture, followed by hard swelling of the scrotum. Many animals die of infection of this kind, especially if drainage is poor.

By means of another instrument of castration, which has recently come into use, the cords are severed by crushing without cutting the skin. The jaws of this instrument are clamped successively on each cord, about half an inch above the testicle in fawns, or an inch above in larger animals. With the instrument in place the cord is kneaded just inside the jaws and above the testicle for about 10 seconds.

Finally a slight pull toward the testicle severs the cord, and the instrument is then released. The scrotum is not cut, the severing of the cord making removal of the testicles unnecessary. The method thus has the advantage of not leaving an open wound subject to infection, but efficient handling requires a thoroughly trained operator.

SHELTER

Reindeer on ranch or range require special protection during the insect-pest season. Where animals are held under fence, this may be furnished by locating summer pasturage on high ground exposed to the wind or sheltered by brush; by constructing shaded shelters, such as a barn or a shed; or by treating the animals with fly repellents, especially about the face and legs. On the range, protection is provided by locating the summer pasture on ground exposed to the wind or affording shaded timber and water in which to wade or swim. On the coast, the herds summer along the wind-swept beach areas; in the large river valleys they often resort in summer to the shallow water along sand bars for protection; and in the interior they summer along the wind-swept upper slopes and ridges. Where there are glaciers or snow fields, the reindeer may find favorable resting places on the ice.

BREEDING

The size and type of reindeer can be considerably improved, and particular attention should be given to breeding up the herds. Selective breeding is the first and most important step toward establishing a better grade of stock. Only consistent reproducers that are large and of suitable type and color should be used for breeding; all scrub, sickly, or otherwise undesirable animals should be promptly eliminated from the herd. It is important to eliminate inferior does, as well as undesirable bucks.

White animals are of inferior grade and should be removed from the breeding herd, the males by castration and the does by slaughtering. Spotted reindeer, while superior to the white animals, are inferior to the dark ones, and those of the lighter shades may well be disposed of. The distinctly steel-gray reindeer, however, seem to be fully as large and strong as the dark-colored animals and are suitable for breeding. The dark-colored animals are the best, and breeding, therefore, should be generally toward the dark color.

An interchange of selected bucks between herds is desirable, and crossbreeding with large, selected caribou has been undertaken. A crossbreeding project was initiated on Nunivak Island in 1925 in cooperation with the owner of a small herd of reindeer on the island, and a more detailed study is being conducted at the Reindeer Experiment Station. Developing a larger and stronger animal through transmission of the rangier size and stronger bone of the caribou to the reindeer should result not only in a heavier meat producer but also in an animal that will be a better breeder, more rugged and vigorous, and better able to shift for itself on the range (fig. 18).

Results of the experiment thus far indicate that the introduction of caribou in the Nunivak Island reindeer herd is increasing the size of the offspring. Animals having outstanding caribou characters are larger than those of pronounced reindeer features. The crosses are more easily recognized among yearlings and older animals, and

the measurements of these show more marked differences in size than do those of fawns. In the herd the caribou males are leaders, being larger, stronger, and more agile and aggressive than the reindeer bucks. The horns of caribou males are earlier developed and larger than those of the reindeer. In contrast to the reindeer, the caribou cross has a tendency toward a straight to roman nose, larger and coarser ears, more pronounced hump at shoulders, longer hind legs, longer tail, and larger frame. In general features and conformation it resembles the caribou more than it does the reindeer.

Initial crossbreeding at the experiment station resulted in both caribou-reindeer crosses and reindeer-caribou, or reciprocal, crosses. The birth weights were from 13 to 16 pounds. Reindeer at birth usually weigh 10 to 13 pounds. A gain over reindeer was more clearly indicated in later development, the average weight of the reindeer fawns at 2 months of age being 38.5 pounds and that of

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FIGURE 18.—Caribou doe and reindeer-caribou cross fawn. (See also reindeer doe and fawn in cover illustration.)

the caribou crosses 62.5 pounds. On Nunivak Island adult crosses show an increase in weight of 50 to 100 pounds over that of the average reindeer. The cross fawn appears of stockier build than either the reindeer or the caribou (fig. 7, *C*). The shoulder hump is pronounced.

GESTATION

At the Reindeer Experiment Station the breeding of the reindeer does occurred between September 5 and September 16, of the caribou does on October 4. The first fawn was dropped on May 4, the last on May 16. In a succeeding season reindeer fawns were dropped from April 5 to May 29. An average gestation period of approximately 240 days is indicated for both reindeer and caribou at the experiment station.

FAWNING

Both reindeer and caribou took particular care of their fawns during the first 12 to 14 days after birth. Thereafter each doe seemed to consider her fawn strong enough to get along with less

attention. Up to that time the does avoided human presence as much as possible and were shy and wary; at the end of that period, however, human presence was again tolerated.

No difficulty has been experienced in obtaining weights of newborn fawns at the station. The fawn, when dry, is placed feet up in a wire basket and the basket set on the scales. The reindeer doe shows no inclination to refuse the fawn following the handling. She protests against anyone taking the fawn, however, and usually one man is required to ward off the attack of the mother while another man does the weighing. The caribou doe guards her fawn more determinedly.

COMPARISON OF REINDEER AND CARIBOU

The caribou is far more spirited than the reindeer, and the caribou doe apparently takes better care of her fawn. Tamed caribou on the range are hard to catch, but when caught are docile. Caribou rut 2 weeks to a month later than reindeer, the reindeer season being from August 20 to October 10, and the caribou season from September 10 to November 1. At this time the horns have shed the velvet. Males of both caribou and reindeer come into rut 10 days to 2 weeks earlier than the does.

Generally the larger caribou are superior in size to reindeer, and therefore desirable for use in breeding up the reindeer, but the smaller caribou may be inferior to the reindeer and therefore undesirable for breeding. Superior reindeer, unfortunately too few in the Alaska herds, may be as suitable for breeding-up purposes as the caribou. Such animals should be diligently sought and retained for breeding.

FEEDING

Feeding tests made at the Reindeer Experiment Station and when transporting animals have shown that both reindeer and caribou may be maintained in good condition on such cultivated feeds as hay and grain (fig. 6, *B*), though in fall and winter the animals prefer lichens. Alfalfa hay, vetch hay grown locally, pea hay, timothy hay, alfalfa meal, alfalfa molasses meal, oats, barley, mixed chop feed, cracked corn, and linseed meal have been successfully used. Linseed meal is of value only in relatively small quantities. Corn, highly palatable but too harsh for young stock, may cause fatal derangement of the digestive tract. A mixed feed seems preferable; too much of a single high-protein feed may give bad results.

A sudden change in diet is dangerous. The herd may best be moved from pasture to feed lot when there is a natural change in forage conditions; that is, in fall or in spring. In midsummer or midwinter, unthrifty animals are likely to die from the effects of abrupt variations in diet. Only thrifty stock should be selected for feed lots. The safest procedure in shifting from natural forage to cultivated feeds is to taper off on lichens for a few days, though in the spring and fall a direct change to cultivated feeds may be made without resort to lichens.

When beginning feeding, the herder should give the animals only about 50 percent of a full feed and then gradually increase the quantity. Usually about a week to 10 days is required to attain the full feed.

The daily feeding of mixed hay and grain required for maintaining reindeer in good condition is approximately 18 pounds to 1,000 pounds live weight. When alfalfa hay is used about half is wasted, as only the finer parts are eaten. A good substitute for this hay is a mixture of alfalfa meal and alfalfa molasses meal, all of which is eaten. When lichens are being fed, reindeer lose weight on a ration of 20 pounds to 1,000 pounds live weight.

A good feed for reindeer consists of equal portions of grain, hay, and meal. Whole oats, crushed barley, and mixed chop feed are excellent for this purpose and are relished by the animals. It is better to mix grain and meal than to feed them separately. On a suitable ration of cultivated feeds, reindeer may be made to gain as much as a pound a day in weight. A ratio of 1 part of digestible protein to between 5 and 6 parts of other digestible nutrients appears desirable; further investigation, however, is necessary to determine the best balanced ration.

Male reindeer respond best to feeding. Animals having a nervous disposition and those with a narrow, pointed face and head are sure to prove poor feeders and poor breeders. Such animals are undesirable, and should not be selected either for feeding or for breeding. Fawns can readily be fattened in fall; the resulting production of fawn meat may be especially desirable in connection with farm development in the interior. Fall feeding is particularly effective for experimental animals, sled reindeer, and reindeer to be transported.

Aside from improved weight, feeding has a marked effect on the animal's physiological condition. A number of reindeer fed at the experiment station during the spring of 1928 shed their winter coats by July 5, which was 20 days earlier than animals in pasture shed theirs. One reindeer buck among those fed shed the horn velvet and came into rut July 28, three weeks earlier than the earliest normal date. This same buck the previous year came into rut August 10, 10 days earlier than the normal time, owing likewise to feeding. Does in the feed lot shed the velvet and came into rut August 24, 2 weeks earlier than those in pasture.

MINERAL REQUIREMENTS

Salt is as necessary for reindeer as for other classes of livestock. On the coast the reindeer obtain it in summer by drinking sea water or licking up saline deposits on the beach. In the interior, however, where little or no salt is available for the grazing animals, lump rock salt or sulphurized block salt should be supplied. Granulated or crushed salt should never be given, as the animals are likely to get too much. A 2-year experiment with reindeer has shown that each animal requires about 4 pounds of salt a year in pasture and 5 pounds in a feed lot.

During the winter, especially in the latter part, when there is much snow on the ground, reindeer are not likely to travel more than half a mile for salt. On winter range it should therefore be distributed over a series of grounds not more than half a mile apart. At the Experiment Station it was observed that animals traveled to salt every 3 to 5 days. Salt is particularly required in spring and in fall upon change in feed.

That reindeer in many instances crave other mineral substances, probably calcium and phosphorus, which may be lacking in the forage, is evidenced by their eating shed antlers, mice, sometimes ptarmigan and ptarmigan eggs, and occasionally dried fish. The absence of shed antlers on a long occupied range, so often remarked, is explained in their having been consumed by the grazing animals. In some sections, furthermore, it has been observed that the older animals will gnaw off the horns of the younger ones before they have been shed, often eating them down to the head.

It is suggested, therefore, that this craving for mineral substance may perhaps be supplied in greater measure through feeding a prepared product, such as bone meal. Such meal, high in calcium and phosphorus, and also blood meal have been tried in feeding experiments at the station. The bone meal, fed in small quantities (2 to 3 ounces a head) mixed with the grain feed, was readily taken. Blood meal similarly fed proved less palatable and was mostly nosed aside. The use of bone meal in feeding is of value, particularly for pregnant does and for young stock, in providing minerals required for building up strong bone and for processes of growth.

COOPERATION AND EXPERIENCE

Reindeer grazing in Alaska at the present time is similar in many respects to the cattle grazing of the early West. Individual ranges are large, and the reindeer move about freely. Strays frequently enter adjoining herds. As a result there is a common cooperative interest in the handling of the animals in each section. In the course of economic progress, particularly as a greater market develops for reindeer products and the animals become more valuable, herd owners will no doubt organize sectional associations for uniform regulation and protection. A common interest has already developed standard practices in marking a 40- to 50-percent increase in fawns to owners of strays, giving owners of neighboring herds notification of round-ups, reporting stray animals to owners, and establishing tentative values of animals as a basis for payment of herding charges. Other rules being considered include restricting the size of cut in earmarking, notifying the unit manager (p. 34) about drives, and bringing to him the ears of animals butchered on the range for check identification.

Reindeer raisers, like those in domestic-livestock enterprises, succeed only as they profit by experience. General principles for handling may be laid down, but essential details are learned first hand. Reindeer vary in temperament and disposition and exhibit a great variety of individual traits. Really to know them, one must observe and actually handle them. An experienced herder is worth half a dozen green hands in working the animals on range or in corral. A class of such herders is now developing in Alaska, particularly among the Eskimos. The Alaska reindeerman is becoming as distinctive in specific knowledge and experience as the sheepman or the cowman of the Western States. The business is still young, however, and much has yet to be learned in the application of modern livestock practices. Steady progress is being made, and added experience will develop a more profitable occupation and a growing industry.

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